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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS & INTERFERENCES

Serial No.	:	09/287,673
Applicant	:	Richard Ferencz et al.
Filed	:	April 7, 1999
TC/A.U.	:	1771
Examiner	:	Norca Torres.Velazquez
Title	:	Hydroentanglement Of Continuous Polymer Filaments
Docket No.	:	PGI6044P0021US
Customer No.	:	32116

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Commissioner For Patents
P.O. Box 1450
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APPEAL BRIEF

Sir:

Applicants are filing this Appeal Brief within two (2) months of the Notice of Appeal filed June 16, 2004, with the appropriate fee according to 37 C.F.R. §1.17(c). If the amount included is incorrect, you are authorized to charge the appropriate amount from Deposit Account No. 23-0785. This Brief is enclosed in triplicate, as required by 37 C.F.R. §1.192.

Real Party In Interest

The real party in interest for application Serial No. 09/287,673 is Polymer Group, Inc., 4838 Jenkins Avenue, North Charleston, South Carolina 29405.

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Related Appeals And Interferences

As of the filing of this Brief, there are no known related appeals or interferences that would directly affect or be directly affected by, or have a bearing on, the Board's decision in this appeal.

Status of Claims

Claims 1-4 and 8-13, the only claims pending in this application, are rejected under 35 U.S.C. §103(a).

Status Of Amendments

There have been no amendments subsequent to the final rejection of the present case.

Summary Of Invention

The present invention is directed to a nonwoven fabric consisting substantially of endless thermoplastic, melt-extruded filaments, which filaments are collected and thereafter hydroentangled. Notably, the filaments are maintained in a substantially continuous form, with hydroentanglement forming interengaged packed loops, with the filaments being substantially free of breaking, wrapping, and knotting. By virtue of this unique nonwoven fabric construct, the hydroentangled fabric has a cross-machine elongation value in excess of 100%, as the meshed coils and loops of filaments disengage and elongate, rather than knot and/or break, under a load.

Issue

The issue in this Appeal is whether pending claims 1-4 and 8-13 are patentable under 35 U.S.C. §103(a), over U.S. Patent No. 3,692,618, to Dorschner et al., in view of U.S. Patent No. 4,107,374, to Kusunose et al., and further, whether pending claims 6-7

are patentable under 35 U.S.C. §103(a) in view of the Dorschner et al. and Kusunose et al. references, and further in view of U.S. Patent No. 4,808,467, to Suskind et al.

Grouping Of Claims

Claim 1, and claims 2-5, and 8-12 depending therefrom, are directed to the present nonwoven fabric construct, with the dependent claims reciting preferred structural characteristics of such a nonwoven fabric.

Claims 6-7, depending from independent claim 1, respectively specify selected surface treatment of the nonwoven fabric recited in claim 1, and preferred applications for the claimed nonwoven fabric construct.

Independent claim 13 recites a particularly preferred combination of structural features for the present nonwoven fabric construct.

In accordance with 37 C.F.R. 1.192(c)(7), applicants state that the claims do not stand or fall together, and that the claims, as grouped, above, are considered to be separately patentable.

Argument

Introduction

The present invention contemplates a novel, nonwoven fabric construct formed from *hydroentangled, continuous spunbond filaments*. Formation of this fabric is contrary to conventional wisdom, in that it was believed that hydroentanglement of long filaments would dissipate the hydraulic energy imparted to the fabric. By forming a fabric contrary to conventional wisdom, having substantially endless filaments which are in the form of highly interengaged packed loops, while being substantially free of breaking, wrapping, and knotting, applicants have produced a fabric construct which

exhibits unique tensile strength and elongation characteristics. Conventionally, the tensile strength of spunbond fabrics decreases attendant to elongation, as the filaments tighten, knot, and break. In the present fabric, *high tensile strength and elongation characteristics are obtained simultaneously*, as the interengaged continuous filaments *disengage without substantial breakage*.

Moreover, the present nonwoven fabric can be very efficiently formed by a *continuous process*, as melt-extruded spunbond filaments are formed and collected, and can immediately thereafter be hydroentangled, thus greatly facilitating cost-effective fabric formation.

Thus, the present nonwoven fabric construct has been formed by a technique contrary to conventional wisdom in the art, with the result being a fabric construct which exhibits unique structural characteristics. It is respectfully submitted that these are important considerations in concluding that the present invention, as claimed, is non-obvious, and patentable in view of the cited prior art.

Examiner's Rejection

Applicants appreciate the Examiner's thorough consideration of this application, and careful explanation of her position. Nevertheless, it is believed that the present nonwoven fabric construct is clearly patentable from the prior art, and reconsideration of the Examiner's rejection is respectfully solicited.

The Examiner's rejection of the pending claims under 35 U.S.C. §103(a) is based principally upon U.S. Patent No. 3,692,618, to Dorschner et al., in view of U.S. Patent No. 4,107,374, to Kusunose et al. It is respectfully maintained that it would not

be an obvious expedient to one skilled in the art to combine the teachings of these references to arrive at applicants' novel nonwoven fabric construct, as claimed.

Referring first to the principal Dorschner et al. reference, this patent contemplates an improvement in the spunbond process by attempting to avoid "stratification," which is understood to refer to layering of fiber bundles as they are collected on an associated carrier surface. At column 7, lines 28 *et seq.*, formation in this fashion is discussed:

> The present invention avoids such stratification by providing for simultaneous formation, intermingling and overlapping of filament, self-bundles, loops and swirls in adjacent lay-down sections.
>
> In the lay-down of the web in accordance with this invention, at least 50% of the width of a section overlaps with the next adjacent section.

The Dorschner et al. references goes on to state:

> In the present invention, overlapping is achieved without stratification by arranging the air guns in a row straight across the moving belt, i.e., at right angles to the direction of longitudinal movement of a carrier belt to provide an overlapping series of air columns as shown in FIG. 5.

The Dorschner et al. patent contemplates that a web formed in this fashion is "consolidated" to form a useful product. At column 10, line 23 *et seq.*, it is stated:

> Once the web is completely laid down on the carrier surface in accordance with this invention, the web may be consolidated and stabilized by compacting, heat-sealing, needling, and latex treating.

The thrust of this critical teaching in the principal Dorschner et al. reference cannot be ignored. By all of these contemplated "consolidation" processes, continuous

filaments of the web being formed are *essentially locked together*. This is consistent with the discussion which continues at column 10, lines 50 *et seq.*, where it is stated:

> When the webs are consolidated by the application of heat, welding together of the filament bundles is effected at filament intersections of crossing filament bundle loops laying approximately on straight lines. . . . . This pattern results in the *low elongation*, the high dimensional stability, and the unusually high tensile strength of products according to the invention.

The conclusion that must be reached from the study of this principal reference is undeniable: the principal reference upon which the present rejection is based *specifically teaches away* from forming a fabric exhibiting both *high elongation and high tensile strength* as specifically claimed, which is a direct result of *hydroentanglement* of a continuous web filament. As specifically claimed, such high elongation values are obtained in the present fabric construct as the filaments *disengage without substantial breakage*, which is simply beyond, and in fact, inconsistent with, the teachings of the principal Dorschner et al. reference.

As acknowledged by the Examiner, Dorschner et al. fails to teach or suggest the use of hydroentanglement for web formation. Rather, the clear thrust of this patent is to avoid filament stratification during spunbond formation. There is no suggestion whatsoever of forming a fabric having the unique tensile strength/elongation characteristics of applicants' fabric as specifically claimed.

The consolidation techniques identified in Dorschner et al. do not include hydroentanglement, but rather are limited to compacting, heat-sealing, latex treatment, and needling. It is important to note that needling contemplates mechanical needle-

punching with barbed needles, a distinctly different process than hydroentanglement with high-pressure liquid streams.

The secondary Kusunose et al. reference contemplates formation of an artificial leather product. To this end, fibrous bundles are employed which "may either be in the form of a continuous filament or a staple fiber and may consist of any type of filament or fiber" (column 1, lines 63 *et seq.*). The fiber bundle is comprised of a plurality of extremely fine filaments or fibers having a denier of about 0.005 to 0.5 (column 3, lines 3-5). Notably, this patent specifically teaches away from the use of filaments having a denier larger than 0.5, stating that "the resultant artificial leather has poor flexural softness (column 3, lines 10-12).

Kusunose et al. alternately teaches formation of fibrous bundles into a fabric for subsequent impregnation with an elastic synthetic polymer by needle punching, or air or water jet treatment. At column 8, lines 3 *et seq.*, such treatment is discussed, including the disclosure of various types of barbed and non-barbed needles for needle punching.

At column 8, line 14 *et seq.*, Kusunose et al. states:

> By the action of the needle or said jet of fluid, the fibrous bundle is divided into small bundles, as illustrated in FIGS. 12A-12D, for example. The bundle of FIG. 12A is composed of two individual fibers which are adhered to each other at certain portions thereof, but which are separated from the other at the remaining portions thereof. In the bundle of FIG. 12B, several individual fibers are adhered to each other at some portions thereof but are separated from each other at other portions thereof. In the bundle of FIG. 12C, the individual fibers are randomly adhered to adjacent fibers and divided from the adjacent fibers at random. In addition, some of the individual fibers are entangled with adjacent fibers at random. FIG 12D shows a compact bundle composed of fine individual fibers firmly adhered to adjacent fibers.

Thus, this patent contemplates the use of needle punching, air jets, or water jets to effect *separation of fibrous bundles*, comprising multiple filaments or fibers, into individualized fiber or filaments, along at least a portion thereof. This patent does not teach or suggest a modification of the Dorschner et al. spunbond formation process, nor does Kusunose et al. teach or suggest the use of high-pressure liquid streams for treatment of collected filamentary elements having a denier of 0.5 to 3 (claim 1), or more particularly 1.0 to 2.5 (claim 13). There is no teaching or suggestion in this reference of achieving a nonwoven fabric having mechanical properties as specifically claimed. This is not surprising since Kusunose et al. merely contemplates use of needle punching, or air or water jets as an intermediate step for processing fibrous bundles for subsequent impregnation with polymeric material to produce synthetic leather.

The Examiner has stated that it is her position that "the fibrous bundles taught by Kusunose et al. read on the present meshed coils and loops." Applicants must respectfully disagree. As noted, it was contrary to the conventional wisdom in the art to effect hydroentanglement of spunbond continuous filaments, particularly those within standard denier ranges as claimed. This is evidenced by Kusunose et al., which is *specifically limited* in its disclosure to use of relatively small-diameter filaments or fibers, especially those of less than 0.5 denier. Moreover, because Kusunose et al. specifically contemplates subsequent impregnation with polymeric material for formation of synthetic leather, there is little concern, much less any specific teaching, of providing a nonwoven fabric structure exhibiting the unique combination of high tensile strength and elongation values, in accordance with the claims presently on appeal.

In the Action, the Examiner has stated that "Kusunose et al. show that hydroentanglement is an equivalent process known in the art that provides mechanical means to produce the nonwoven," and that these two processes were "art-recognized equivalents at the time the invention was made."

Applicants have previously refuted this position by submission of on-line industry publications, demonstrating the recognition in the art that *needle punching inevitably damages fibers.*

The Examiner has now taken the position that this recognition in the art would motivate one skilled in the art to select the hydroentanglement process, as opposed to needle punching.

It is respectfully maintained that both positions cannot be properly maintained. The Examiner first maintains that needle punching and hydroentanglement are recognized as equivalents, but then acknowledges that one skilled in the art would be motivated to select one process versus the other. Considering that the principal Dorschner et al. reference is specifically limited in its teachings to *locking filaments together* such as by the use of needle punching, and that the secondary Kusunose et al. reference has been relied upon to demonstrate the equivalence of needle punching and hydroentanglement, it is believed that only applicants' own disclosure reconciles these conflicting views, *particularly considering the relatively thick denier filaments to which applicants' claims on appeal are directed.*

Even with consideration of the combined teachings of the Dorschner et al. and Kusunose et al. references, it simply cannot be denied that neither of these references recognize, or in any way teach or suggest , the unique physical properties of applicants'

claimed nonwoven fabric construct, wherein a combination of *high tensile strength and high elongation* is obtained. As noted, high elongation values are achieved as meshed coils and loops of filaments *disengage*, and the filaments straighten and elongated under a load, *without substantial breakage*. As extensively discussed in applicants' specification, this is in clear distinction from the typical knotting and breakage of hydroentangled, staple fiber constructs, and is also distinct from the elongation characteristics of needle punched constructs, wherein significant fiber/filament damage inevitably weakens fibers, and precludes comparable elongation/tensile strength performance.

While the Examiner has relied upon the Suskind et al. reference for its teachings relating to the use of various polymers for continuous filaments, it is respectfully maintained that this reference clearly fails to overcome the deficiencies in the combined teachings of the principal Dorschner et al. reference and the Kusunose et al. reference. As specifically noted by the Examiner, Suskind et al. discloses a fabric formed by hydraulically entangling wood pulp and staple fibers with a continuous filament base web. Integration of the wood pulp with the base web is the contemplated objective, rather than hydroentanglement of the continuous filaments to form interengaged packed loops, as claimed, to create a nonwoven fabric construct having a unique combination of high tensile strength/high elongation. Again, such physical properties are *contrary to* the typical *inverse relationship exhibited between tensile strength and elongation of nonwoven fabrics,* wherein knotting and breakage of filaments and/or fibers results in a decrease in tensile strength as the construct is elongated.

During prosecution, applicants have referred to *The Manual of Patent Examining Procedure*, Section 2143.01, addressing proper rejections under 35 U.S.C. §103(a). First, the M.P.E.P. specifically requires that "the prior art must suggest the desirability of the claimed invention," and that "the level of skill in the art cannot be relied upon to provide the suggestion to combine the references" (citations omitted). Applicants must respectfully maintain that there is *no teaching* in the Dorschner et al. and Kusunose et al. references which would suggest the desirability of combining their teachings, or that the continuous filament of the Dorschner et al. nonwoven fabric should be subjected to hydroentanglement, in light of the teachings of Kusunose et al., since Kusunose et al. *teaches away from the claimed filament denier range*. The M.P.E.P. further admonishes that "the proposed modification cannot change the principle of operation of a reference," yet the Examiner relies upon the teachings of Kusunose et al., to modify the teachings of Dorschner et al., when Kusunose et al. teaches away from hydroentanglement of relatively large diameter filaments, as specifically set forth in the claims on appeal, and the principal Dorschner et al. reference teaches locking filaments together to achieve "low elongation" values; contrary to the specifically claimed structural features of the present fabric.

In view of the foregoing, reversal of the Examiner's rejection is respectfully solicited.

The Commissioner is hereby authorized to charge any additional fees which may be required in connection with this submission to Deposit Account No. 23-0785.

Respectfully submitted,

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APPENDIX

Listing of Claims:

Claim 1. A nonwoven fabric consisting of substantially endless thermoplastic melt extruded spunbond filaments having a denier of 0.5 to 3, wherein said filaments are collected and thereafter hydroentangled in the form of interengaged packaged loops, with the filaments being substantially free of breaking, wrapping, and knotting, and wherein said hydroentangled fabric has a cross machine elongation value in excess of 100% as meshed coils and said loops of said filaments disengage and elongate under a load.

Claim 2. A nonwoven fabric as in claim 1, wherein said filaments have a denier of about 1.0 to 2.5.

Claim 3. A nonwoven fabric as in claim 1, wherein said thermoplastic melt extruded filaments comprise plyolefins, polyamide, or polyesters.

Claim 4. A nonwoven fabric as in claim 1, wherein said nonwoven fabric has a basis weight of between about 20 and 450 g/m^2.

Claim 8. A nonwoven fabric as in claim 1, wherein said fabric has a machine direction elongation value of at least 75% and a cross-direction elongation value of at least 100%.

Claim 9. A nonwoven fabric as in claim 1, wherein said fabric has a fiber entanglement frequency of at least 10.0 , and a fiber entanglement value of at least 1.00.

Claim 10. A nonwoven fabric as in claim 1, wherein said fabric has a fiber interlock value of at least 15.

Claim 11. A nonwoven fabric as in claim 1, wherein said continuous web of substantially endless thermoplastic melt extruded filaments comprises a plurality of layers of said web of substantially endless continuous filaments.

Claim 12. A nonwoven fabric as in claim 1, wherein said interengaged packed loops provide a structure wherein cross-direction elongation is directly proportional to cross-directional tensile strength.

Claim 13. A nonwoven fabric consisting of substantially endless melt extruded thermoplastic spunbond filaments having a denier of about 1.0 to 2.5, wherein said filaments are collected and thereafter hydroentangled in the form of interengaged packed loops, with the filaments being substantially free of breaking, wrapping, and knotting; said fabric having a basis weight of between about 10 and 450 gm/m^2, having a machine direction elongation value of at least 75% and a cross direction value of at least 100%, having a fiber entanglement frequency of at least 10.0, a fiber entanglement completeness value of at least 1.00, a fiber interlock value of at least 15, said fabric elongating as meshed coils and loops of said filaments disengage and said filaments straighten and elongate under a load.

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I hereby certify that the enclosed **Appeal Brief** and any other documents referred to as enclosed herein, are being deposited in an envelope with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated below and addressed to: Mail Stop Appeal Brief - Patents, Commissioner for Patents, P.O. Box 1450, Alexandria Virginia 22313-1450.

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Signature:	Colleen Davison